SHORT COMMUNICATIONS

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WINTER DIET OF THE BARN OWL (*TYTO ALBA*) AND LONG-EARED OWL (*ASIO OTUS*) IN NORTHEASTERN GREECE: A COMPARISON

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There have been several comparative studies of the diets of Barn (*Tyto alba*) and Long-eared (*Asio otus*) Owls (Marti 1974, Amat and Soriguer 1981, Mikkola 1983, Delibes et al. 1983, Marks and Marti 1984, Cramp 1985, Capizzi and Luiselli 1996). Dietary information has been useful in documenting the trophic relationships in the areas where the two species are sympatric (Herrera and Hiraldo 1976, Marks and Marti 1984). Greece is within the breeding and wintering areas of these species. Information on the diet of Barn Owl in Greece has come mainly from islands and parts of central and western Greece (Böhr 1962, Cheylan 1976, Pieper 1977, Niethammer 1989, Tsounis and Dimitropoulos 1992). Only a single study has provided information on the diet of these two species on Euboea Island (Akriotis 1981). This study compares the winter diet of the Barn Owl and the Long-eared Owl in a Greek wetland area.

STUDY AREA AND METHODS

Our study was conducted in northeastern Greece near Porto Lagos (40°99′N, 25°32′E) in an area with an extensive coastal wetland complex including lagoons, saltmarshes, mudflats, reedbeds, open cultivated and uncultivated land, small villages, and pinewood plantations. Pellets of Long-eared Owls were collected at a large communal, winter roost in a pinewood and those of Barn Owls were collected in neighboring ruined buildings in February and early March of 1987. Prey were identified according to Brown et al. (1987), Chaline (1974), and MacDonald and Barrett (1993). Mean prey weights were taken mainly from Perrins (1987) for birds, MacDonald and Barrett (1993) for mammals and from our own data for insects.

We estimated the trophic diversity of birds and mammals in the owl diets at the generic level and that of insects at a class level using the antilog of the Shannon Index (NB = $\exp H'$, where $H' = -\Sigma p_i \ln p_i$, where p_i represents the proportion of prey items of each genus in the sample. To standardize diversity for comparison between species, we calculated evenness (E) ($N_{2,1} = (N_2 - 1)/(N_1 - 1)$, where $N_1 = \exp H'$ and $N_2 = 1/\Sigma p_i^2$) (Alatalo 1981, Marks 1984). In order to compare the dietary overlap between species in each wetland, we used Pianka's Index (1973), multiplied by 100 to express it as a percentage.

RESULTS

The diets of both owls contained small mammals, birds, and insects, in descending order of importance (Table 1). Small mammals made up 92% of the Barn Owl diet by number and 85% by biomass. At least 10 mammal species were eaten. The most important of them were *Mus* spp. (40% by number and 32% by biomass), *Microtus epiroticus* (20% and 28%), *Apodemus* spp. (7% and 10%), and *Crocidura suaveolens* (19% and 8%). Birds of at least five species formed 6% of the diet by number and 15% by biomass. Insects (orthopterans) were a minor diet constituent (2% by number and less than 1% by biomass). The average prey weight was 14.7 g (range 0.5–70 g) Prey diversity was 5.19 and evenness 0.67.

Mammals made up 89% of the diet by number and 85% by biomass of Long-eared Owls. We identified at least 12 mammalian species in the diet but the main mammalian prey were *Mus* spp. (48% by number and 35% by biomass), *Apodemus* spp. (23% and 28%), and *M. epiroticus* (13% and 15%). Birds (at least 16 species) formed 11% of the diet by number and 15% by biomass, while insects (orthopteran, Tettigoniidae) were less than 1% by both number and biomass. The average prey weight was 16.5 g (range 2–80 g). Prey diversity and evenness values were 4.29 and 0.56, respectively, both being lower than these of the Barn Owl.

The proportions of all mammalian prey, in terms of number and biomass, were very similar in both owl species. Nevertheless, the proportions of the four most important genera (*Mus, Apodemus, Microtus*, and *Crocidura*) differed significantly ($\chi^2 = 208.83$, df = 3, $P < 0.0001$) *Crocidura* were much more abundant in the Barn Owl's diet while *Apodemus* was more common in the Long-eared Owl's diet. Although fewer birds were taken by the Barn

Table 1. Diet of Barn and Long-eared Owls in Porto Lagos.

PREY	BARN OWL			LONG-EARED OWL		
	NUMBER	% NUMBER	% BIOMASS	NUMBER	% NUMBER	% BIOMASS
Insects	7	2.3	0.2	2	0.2	0.1
Tettigoniidae	1	0.3	0.1	2	0.2	0.1
Gryllidae	6	1.9	0.1	—	—	—
Birds	18	5.8	14.7	102	10.6	15.5
Alcedo atthis	—	—	—	1	0.1	0.3
Lullula arborea	—	—	—	2	0.2	0.4
Alauda arvensis	—	—	—	1	0.1	0.2
Galerida cristata	—	—	—	9	0.9	1.8
Phylloscopus spp.	—	—	—	3	0.3	0.2
Erithacus rubecula	—	—	—	4	0.4	0.5
Turdus spp.	—	—	—	3	0.3	1.5
Aegithalos caudatus	—	—	—	6	0.6	0.3
Parus caeruleus	1	0.3	0.2	2	0.2	0.1
Parus spp.	—	—	—	4	0.4	0.3
Sturnus vulgaris	3	1.0	4.6	2	0.2	0.9
Emberiza spp.	1	0.3	0.5	2	0.2	0.3
Miliaria calandra	5	1.6	4.4	—	—	—
Fringilla coelebs	—	—	—	11	1.1	1.4
Carduelis chloris	—	—	—	3	0.3	0.6
Carduelis spp.	—	—	—	2	0.2	0.2
Serinus serinus	—	—	—	3	0.3	0.2
Passer spp.	3	1.0	1.6	10	1	1.6
Unident.	5	1.6	3.3	34	3.5	4.3
Mammals	286	92.0	85.1	857	89.2	84.5
Crocidura leucodon	6	1.9	1.1	3	0.3	0.2
Crocidura suaveolens	60	19.3	7.9	3	0.3	0.1
Suncus etruscus	2	0.6	0.1	1	0.1	<0.1
Talpa europaea	—	—	—	2	0.2	0.9
Rhinolophus ferrumequinum	—	—	—	1	0.1	0.1
Myotis sp.	—	—	—	1	0.1	0.1
Pipistrellus sp.	1	0.3	0.1	—	—	—
Tadarida teniotis	—	—	—	1	0.1	0.2
Microtus epiroticus	63	20.3	27.6	121	12.6	15.2
Arvicola terrestris	1	0.3	1.3	—	—	—
Micromys minutus	2	0.6	0.2	—	—	—
Apodemus spp.	23	7.4	10.1	219	22.8	27.6
Rattus rattus	3	1.0	3.9	—	—	—
Rattus norvegicus	—	—	—	1	0.1	0.4
Rattus spp.	—	—	—	1	0.1	0.4
Mus spp.	125	40.2	31.6	464	48.3	35.1
Unident. Muridae	—	—	—	33	3.4	3.1
Unident. Rodentia	—	—	—	6	0.6	1.1
Total	311	100	100	961	100	100

Owl, some larger-sized species (*Sturnus, Miliaria*) were proportionally more common, so bird biomass was similar in the diet of both owls. Average prey weights were similar. Both the total prey overlap and mammalian prey overlap of the two owl species were 86%.

DISCUSSION

We found small mammals to be the most important prey of both Barn and Long-eared Owls in northeastern Greece. In other Greek areas, Barn Owls have also been reported to prey mainly on small mammals (4–15 spe-

cies), mice (*Mus* or *Apodemus*) being the most important prey by number and usually also by biomass (Akriotis 1981, Böhr 1962, Cheylan 1976, Tsounis and Dimitropoulos 1992). On some islands such as Crete and Corfu, a diverse spectrum of bat species was taken but in low overall proportions (Böhr 1962, Pieper 1977). In comparison to the Barn Owl's diet in Euboea (Akriotis 1981), we found higher biomass proportions of birds (15% vs. 3%) and *C. suaveolens* (8% vs. 1%) but similar proportions of *Apodemus* (10% vs. 11%). In contrast, the diet of the Long-eared Owls we studied had higher proportions of birds (32% vs. 15% by biomass) and *Apodemus* (34% vs 28%) but those of *C. suaveolens* were low (both <1%). In Euboea, Long-eared Owls preyed upon some mammal species not found in our study. While owls probably differ in terms of the species of mammals they eat in various habitats (Akriotis 1981, MEHPW 1986), they seem to consistently use mammals as their most common prey source.

In Europe and the Canary Islands, both owl species are also mainly mammal predators. As in Greece, in some areas the Long-eared Owl's diet can become heavily reliant on birds (Mikkola 1983, Amat and Soriguer 1981, Delgado et al. 1986). Mice and voles, where abundant, are often the main prey of both species, but their relative proportions in diets vary greatly among areas (Cramp 1985, Taylor 1994). In the U.S., both owl species are primarily mammalian predators but the Long-eared Owl tends to prey on *Microtus* spp. in lower proportions than the Barn Owl, taking fewer birds than in Europe (2% vs. 14% by biomass) (Marti 1976, Marks and Marti 1984).

Bunn et al. (1982) have described the Barn Owl as an unspecialized predator of small mammals while Taylor (1994) suggested that it shows a definite preference for *Microtus* because they are of small size and easy to capture. Long-eared Owls seem to concentrate on relatively few mammal species regardless of habitat type or location they are found (Marti 1974). There is controversy whether *Microtus* are selected or simply taken according to their availability (Mikkola 1983, Cramp 1985). As far as the availability of small mammals in our area is concerned, among 93 individuals snap-trapped at Porto Lagos area between June 1984–October 1986, 48% were *Mus* spp. (41% *M. abbotti*), 38% *Crocidura suaveolens*, 11% *Apodemus sylvaticus*, and 3% *Microtus epiroticus* (Vohralik and Sofianidou 1992). Trapping results may not reflect the true proportions of small mammals in their habitats (Yom-Tov 1991, Blem et al. 1993), but we felt they were a good indicator of the relative abundance of small mammals in our study area. They indicated that mice *Mus* were mostly taken by both owls probably because they were plentiful. *M. epiroticus* was somewhat preferred by both and *Crocidura suaveolens* was generally avoided, especially by the Long-eared Owl that seemed to prefer *Apodemus*. Although shrews are in general distasteful to many predators, including the Long-eared Owl, Barn Owls have been found to take them in large numbers, a fact frequently related to this prey's local availability (Bunn et al. 1982, Mikkola 1983).

The average prey weight of the Barn Owl in Porto Lagos was within the limits of the European populations (range = 12.8–25 g, Taylor 1994). That of the Long-eared Owl was much lower than that of the rest of Europe (37.4 g, Marti 1976), where *Microtus* spp. (average weight range = 30–35 g) make up a larger percentage of the diet (41.5% vs. 12.6% in our study). The lighter prey weight in our study was primarily due to the preponderance of *Mus* spp. in the diet which weighed only 12 g. Average prey weight in the U.S. is even higher than that in Europe for both species reflecting the availability of larger-sized prey species (Taylor 1994). The higher average prey weight of Barn Owls in the U.S. may also simply be due to its larger size than its European relative (Marti 1974, Marks and Marti 1984, Mikkola 1983).

Dietary overlap of the two species varied greatly in six studies in the U.S. ranging from 56–90% (Marks and Marti 1984). In Spain, overlap was much higher in winter (89%, Delibes et al. 1983) than in summer (69%, Delibes et al. 1983; 78%, Amat and Soriguer 1981). The trophic diversity (H') of Barn Owls in our area was 0.32 and evenness (E) was 0.29 (calculated according to Herrera, on a prey class level). Both values were much lower than those reported in Spanish studies (Herrera 1974) suggesting that Barn Owl in northeastern Greece have a more stenophagic diet and that, unlike the Mediterranean region, prey in Greece, especially some small mammals, are probably not in short supply for owls. The high dietary overlap we found between the two owl species, coupled with the similarity in average prey weights, suggested that the two species are grouped along their food dimension and belong to the same trophic guild of owls wintering in this area.

Also in other areas, where the Barn and Long-eared Owl are syntopic, Barn Owls have been shown to have a broader diet (Marti 1976, Amat and Soriguer 1981, Veiga 1981, Capizzi and Luiselli 1996). This probably results from the high dietary overlap between them and it may facilitate their coexistence in areas of syntopy (Marks and Marti 1984). The noticeable difference in the bird species composition in the diets of the two owl species in our area may simply have been related to differences in their hunting habits. Although both forage in the open, Long-eared Owls also hunt under tree canopy (Cramp 1985) (which may also account for the higher proportion of *Apodemus* taken) and they also raid bird roosts in bushes and trees to a much greater extent than Barn Owls.

RESUMEN.—En Porto Lagos (noreste de Grecia), las dietas de invierno de *Tyto alba* y *Asio otus* consistieron básicamente de pequeños roedores (en ambos 85% de la biomasa). Ratones (*Mus* y *Apodemus*) y ratas (*Microtus epiroticus)* fueron las presas mas importantes para ambos buhos. Las musarañas (*Crocidura*) fueron importantes solamente para *Tyto alba* (8% de la biomasa). Las

proporciones de las presas de los cuatro mamíferos mas abundantes fueron significativamente diferentes entre los buhos. Mas especies de aves fueron capturadas por *Asio otus* (16 vs. 5) pero la contribución a la biomasa fue similar para los dos (15%). El promedio del peso de las presas fue similar (*Tyto alba*: 14.7 g; *Asio otus*: 16.5 g), la diversidad de presas fue mayor en *Tyto alba* (5.19 vs. 4.29). Las dietas coincidieron en un 86%.

[Traducción de César Márquez]

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